

Atty. Dkt. No. 0709.017.0002
Serial No. 10/040,077

AMENDMENTS**Amendments to the Claims**

Claims 1-16 (canceled)

17. (Withdrawn) A method for glucose detection comprising:

- (b) providing at least one mutated glucose/galactose binding protein and at least one reporter group attached thereto;
- (c) exposing said mutated glucose/galactose binding protein to varying glucose concentrations;
- (d) detecting a detectable and reversible signal change from said reporter group wherein said detectable and reversible signal change corresponds to said varying glucose concentrations.

18. (Withdrawn) The method of claim 17 wherein said detecting is continuous, programmed, episodic, or combinations thereof.

19. (Withdrawn) The method of claim 17 wherein said mutated glucose/galactose binding protein is selected from bacterial periplasmic binding proteins.

20. (Withdrawn) The method of claim 17 wherein said detecting of detectable and reversible signal changes from said reporter group of varying glucose concentrations is *in vivo*.

21. (Withdrawn) The method of claim 17 wherein said binding protein has one amino acid substitution.

22. (Withdrawn) The method of claim 17 wherein said binding protein has at least two amino acid substitutions.

23. (Withdrawn) The method of claim 17 wherein said binding protein has at least three amino

Atty. Dkt. No. 0709.017.0002
Serial No. 10/040,077

acid substitutions.

24. (Withdrawn) The method of claim 21 wherein said one amino acid substitution is selected from the group consisting of a cysteine at position 11, a cysteine at position 14, a cysteine at position 19, a cysteine at position 43, a cysteine at position 74, a cysteine at position 107, a cysteine at position 110, a cysteine at position 112, a cysteine at position 113, a cysteine at position 137, a cysteine at position 149, a cysteine at position 213, a cysteine at position 216, a cysteine at position 238, a cysteine at position 287, and a cysteine at position 292.

25. (Withdrawn) The method of claim 24 wherein said glucose/galactose binding protein has at least one histidine tag.

26. (Withdrawn) The method of claim 22 wherein said glucose/galactose binding protein has at least two amino acid substitutions selected from the group consisting of a cysteine at position 112 and a serine at position 238, a cysteine at position 149 and a serine at position 238, a cysteine at position 152 and a cysteine at position 182, a cysteine at position 152 and a serine at position 213, a cysteine at position 213 and a cysteine at position 238, a cysteine at position 149 and an arginine at position 213.

27. (Withdrawn) The method of claim 26 wherein said glucose/galactose binding protein has at least one histidine tag.

28. (Withdrawn) The method of claim 23 wherein said glucose/galactose binding protein has at least three amino acid substitutions selected from the group consisting of a cysteine at position 149 and a serine at position 213 and a serine at position 238, and a cysteine at position 149 and an arginine at position 213 and a serine at position 238.

29. (Withdrawn) The method of claim 28 wherein said glucose/galactose binding protein has at

Atty. Dkt. No. 0709.017.0002
Serial No. 10/040,077

least one histidine tag.

30. (Withdrawn) The method of claim 17 wherein said at least one reporter group is a liminescent label.

31. (Withdrawn) The method of claim 30 wherein said luminescent label has an excitation wavelength of more than about 600 nanometers.

32. (Withdrawn) The method of claim 30 wherein said luminescent label has an emission wavelength of more than about 600 nanometers.

33. (Withdrawn) The method of claim 30 wherein said luminescent label is covalently coupled to said at least one glucose/galactose binding protein by reaction with said at least one mutated binding protein and a member selected from the group consisting of fluorescein, coumarins, rhodamines, 5- TMRIA (tetramethylrhodamine-5-iodoacetamide), Quantum Red™, Texas Red™, Cy3, N-((2-iodoacetoxy)ethyl)-N-methyl)amino-7-nitrobenzoxadiazole (IANBD), 6-acryloyl-2-dimethylaminonaphthalene (acrylodan), pyrene, Lucifer Yellow, Cy5, Dapoxyl® (2-bromoacetamidoethyl)sulfonamide, (N-(4,4-difluoro-1,3,5,7-tetramethyl-4-bora-3a,4a-diaza-s-indacene-2-yl)iodoacetamide (Bodipy507/545 IA), N-(4,4-difluoro-5,7-diphenyl-4-bora-3a,4a-diaza-s-idacene-3-propionyl)-N'-iodoacetylenelediamine (BODIPY® 530/550 IA), 5-(((2-iodoacetyl)amino)ethyl)amino)naphthalene-1-sulfonic acid (1,5-IAEDANS), and carboxy-X-rhodamine, 5/6-iodoacetamide (XRIA 5,6).

34. (Withdrawn) A composition comprising:

a mutated glucose/galactose binding protein having at least one amino acid substitution selected from the group consisting of a cysteine at position 11, a cysteine at position 14, a cysteine at position 19, a cysteine at position 43, a cysteine at position 74, a cysteine at position 107, a cysteine at position 110, a cysteine at position 112, a cysteine at position 113, a cysteine at

Atty. Dkt. No. 0709.017.0002
Serial No. 10/040,077

position 137, a cysteine at position 149, a cysteine at position 213, a cysteine at position 216, a cysteine at position 238, a cysteine at position 287, and a cysteine at position 292.

35. (Withdrawn) The composition of claim 34, wherein said mutated glucose/galactose binding protein has at least one histidine tag.

36. (Withdrawn) The composition of claim 34 wherein said mutated glucose/galactose binding protein further has at least one reporter group.

37. (Withdrawn) The composition of claim 36 wherein at least one reporter group is a luminescent label.

38. (Withdrawn) The composition of claim 37 wherein said luminescent label has an excitation wavelength of more than about 600 nanometers.

39. (Withdrawn) The composition of claim 37 wherein said luminescent label has an emission wavelength of more than about 600 nanometers.

40. (Withdrawn) The composition of claim 37 wherein said luminescent label is covalently coupled to said at least one glucose/galactose binding protein by reaction with said at least one mutated binding protein and a member selected from the group consisting of fluorescein, coumarins, rhodamines, 5-TMRIA (tetramethylrhodamine-5-iodoacetamide), Quantum Red™, Texas Red™, Cy3, N-((2-iodoacetoxy)ethyl)-N-methyl)amino-7-nitrobenzoxadiazole (IANBD), 6-acryloyl-2-dimethylaminonaphthalene (acrylodan), pyrene, Lucifer Yellow, Cy5, Dapoxyl® (2-bromoacetamidoethyl)sulfonamide, (N-(4,4-difluoro-1,3,5,7-tetramethyl- 4-bora-3a,4a-diaza-s-indacene- 2-yl)iodoacetamide (Bodipy507/545 IA), N-(4,4-difluoro-5,7-diphenyl- 4-bora-3a,4a-diaza-s-indacene- 3-propionyl)-N'-iodoacetylenehylenediamine (BODIPY® 530/550 IA), 5-(((2-iodoacetyl)amino)ethyl)amino)naphthalene-1-sulfonic acid (1,5-IAEDANS), and carboxy-X-

Atty. Dkt. No. 0709.017.0002
Serial No. 10/040,077

rhodamine, 5/6-iodoacetamide (XRIA 5,6).

41. (Withdrawn) A composition comprising:

a mutated glucose/galactose binding protein having at least two amino acid substitutions selected from the group consisting of a cysteine at position 112 and a serine at position 238, a cysteine at position 149 and a serine at position 238, a cysteine at position 152 and a cysteine at position 182, a cysteine at position 152 and a serine at position 213, a cysteine at position 213 and a cysteine at position 238, a cysteine at position 149 and an argine at position 213, and a cysteine at position 149 and a serine at position 213 and a serine at position 238, and a cysteine at position 149 and an arginine at position 213 and a serine at position 238.

42. (Withdrawn) The composition of claim 41 wherein said mutated glucose/galactose binding protein has at least one histidine tag.

43. (Withdrawn) The composition of claim 41 wherein said mutated glucose/galactose binding protein further has at least one reporter group.

44. (Withdrawn) The composition of claim 43 wherein at least one reporter group is a luminescent label.

45. (Withdrawn) The composition of claim 44 wherein said luminescent label has an excitation wavelength of more than about 600 nanometers.

46. (Withdrawn) The composition of claim 44 wherein said luminescent label has an emission wavelength of more than about 600 nanometers.

47. (Withdrawn) The composition of claim 44 wherein said luminescent label is covalently coupled to said at least one glucose/galactose binding protein by reaction with said at least one

Atty. Dkt. No. 0709.017.0002
Serial No. 10/040,077

mutated binding protein and a member selected from the group consisting of fluorescein, coumarins, rhodamines, 5-TMRIA Quantum Red™, Texas Red™, Cy3, N-((2-iodoacetoxy)ethyl)-N-methyl)amino-7-nitrobenzoxadiazole (IANBD), 6-acryloyl-2-dimethylaminonaphthalene (acrylodan), pyrene, Lucifer Yellow, Cy5, Dapoxyl® (2-bromoacetamidoethyl)sulfonamide, (N-(4,4-difluoro-1,3,5,7-tetramethyl- 4-bora-3a,4a-diaza-s-indacene- 2-yl)iodoacetamide (Bodipy507/545 IA), N-(4,4-difluoro-5,7-diphenyl- 4-bora-3a,4a-diaza-s-idacene- 3-propionyl)-N'-iodoacetyleneethylenediamine (BODIPY® 530/550 IA), 5-(((2-iodoacetyl)amino)ethyl)amino)naphthalene-1-sulfonic acid (l,5-IAEDANS), and carboxy-X-rhodamine, 5/6-iodoacetamide (XRIA 5,6).

48. (New) A glucose biosensor comprising at least one mutated glucose/galactose binding protein and at least one reporter group attached to said binding protein, such that said reporter group provides a detectable and reversible signal change when said mutated binding protein is exposed to varying glucose concentrations;
wherein said at least one mutated glucose/galactose binding protein comprises at least one amino acid substitution selected from the group consisting of a cysteine at position 11, a cysteine at position 14, a cysteine at position 19, a cysteine at position 43, a cysteine at position 74, a cysteine at position 107, a cysteine at position 110, a cysteine at position 112, a cysteine at position 113, a cysteine at position 137, a cysteine at position 149, a cysteine at position 213, a cysteine at position 216, a cysteine at position 238, a cysteine at position 287, and a cysteine at position 292, and
wherein said detectable and reversible signal change is related to said varying concentrations.

49. (New) The biosensor of claim 48 wherein said reporter group is a luminescent label.

50. (New) The biosensor of claim 48, wherein said mutated glucose/galactose binding protein has at least one histidine tag.

Atty. Dkt. No. 0709.017.0002
Serial No. 10/040,077

51. (New) The biosensor of claim 49 wherein said luminescent label is covalently coupled to said at least one mutated glucose/galactose binding protein.

52. (New) The biosensor of claim 51 wherein said luminescent label has an excitation wavelength of more than about 600 nanometers.

53. (New) The biosensor of claim 51 wherein said luminescent label has an emission wavelength of more than about 600 nanometers.

54. (New) The biosensor of claim 51, wherein said luminescent label is selected from the group consisting of fluorescein, coumarins, rhodamines, 5- TMRIA (tetramethylrhodamine-5-iodoacetamide), (9-(2(or4)-(N-(2-maleimidylethyl)-sulfonamidyl)-4(or 2)-sulfophenyl)-2,3,6,7,12,13,16,17-octahydro-(1H,5H,11H,15H-xantheno(2,3,4-ij:5,6,7-i'j')diquinolizin-18-ium salt), 2-(5-(1-(6-(N-(2-maleimidylethyl)-amino)-6-oxohexyl)-1,3-dihydro-3,3-dimethyl-5-sulfo-2H-indol-2-ylidene)-1,3-propyldienyl)-1-ethyl-3,3-dimethyl-5-sulfo-3H-indolium salt, N-((2-iodoacetoxy)ethyl)-N-methyl)amino-7-nitrobenzoxadiazole, 6-acryloyl-2-dimethylaminonaphthalene, pyrene, 6-amino-2,3-dihydro-2-(2-((iodoacetyl)amino)ethyl)-1,3-dioxo-1H-benz(de)isoquinoline-5,8-disulfonic acid salt, 2-(5-(1-(6-N-(2-maleimidylethyl)-amino)-6-oxohexyl)-1,3-dihydro-3,3-dimethyl-5-sulfo-2H-indol-2-ylidene)-1,3-pentadienyl)-1-ethyl-3,3-dimethyl-5-sulfo-3H-indolium salt, 4-(5-(4-dimethylaminophenyl)oxazole-2-yl)-N-(2-bromoacetamidoethyl)sulfonamide, (N-(4,4-difluoro-1,3,5,7-tetramethyl-4-bora-3a,4a-diaza-s-indacene-2-yl)iodoacetamide, N-(4,4-difluoro-5,7-diphenyl-4-bora-3a,4a-diaza-s-indacene-3-propionyl)-N'-iodoacetylethylenediamine, 5-(((2-iodoacetyl)amino)ethyl)amino)naphthalene-1-sulfonic acid, and carboxy-X-rhodamine, 5/6-iodoacetamide.

55. (New) A glucose biosensor comprising at least one mutated glucose/galactose binding protein and at least one reporter group attached to said binding protein, such that said reporter group provides a detectable and reversible signal change when said mutated binding protein is exposed to varying glucose concentrations;

Atty. Dkt. No. 0709.017.0002
Serial No. 10/040,077

wherein said at least one mutated glucose/galactose binding protein comprises at least two amino acid substitutions, said at least two amino acid substitutions being selected from the group consisting of a cysteine at position 112 and a serine at position 238, a cysteine at position 149 and a serine at position 238, a cysteine at position 152 and a cysteine at position 182, a cysteine at position 152 and a serine at position 213, a cysteine at position 213 and a cysteine at position 238, a cysteine at position 149 and an arginine at position 213; and wherein said detectable and reversible signal change is related to said varying concentrations.

56. (New) The biosensor of claim 55 wherein said reporter group is a luminescent label.

57. (New) The biosensor of claim 55, wherein said mutated glucose/galactose binding protein has at least one histidine tag.

58. (New) The biosensor of claim 56 wherein said luminescent label is covalently coupled to said at least one mutated glucose/galactose binding protein.

59. (New) The biosensor of claim 58 wherein said luminescent label has an excitation wavelength of more than about 600 nanometers.

60. (New) The biosensor of claim 58 wherein said luminescent label has an emission wavelength of more than about 600 nanometers.

61. (New) The biosensor of claim 58, wherein said luminescent label is selected from the group consisting of fluorescein, coumarins, rhodamines, 5- TMRIA (tetramethylrhodamine-5-iodoacetamide), (9-(2(or4)-(N-(2-maleimidylethyl)-sulfonamidyl)-4(or 2)-sulfophenyl)-2,3,6,7,12,13,16,17-octahydro-(1H,5H,11H,15H-xantheno(2,3,4-ij:5,6,7-i'j')diquinolizin-18-ium salt), 2-(5-(1-(6-(N-(2-maleimidylethyl)-amino)-6-oxohexyl)-1,3-dihydro-3,3-dimethyl-5-sulfo-2H -indol-2-ylidene)-1,3-propyldienyl)-1-ethyl-3,3-dimethyl-5-sulfo-3H-indolium salt, N-((2-iodoacetoxy)ethyl)-N-methyl)amino-7-nitrobenzoxadiazole, 6-acryloyl-2-

Atty. Dkt. No. 0709.017.0002
Serial No. 10/040,077

dimethylaminonaphthalene, pyrene, 6-amino-2,3-dihydro-2-(2-((iodoacetyl)amino)ethyl)-1,3-dioxo-1H-benz(de)isoquinoline-5,8-disulfonic acid salt, 2-(5-(1-(6-N-(2-maleimidylethyl)-amino)-6-oxohexyl)-1,3-dihydro-3,3-dimethyl-5-sulfo-2H-indol-2-ylidene)-1,3-pentadienyl)-1-ethyl-3,3-dimethyl-5-sulfo-3H-indolium salt, 4-(5-(4-dimethylaminophenyl)oxazole-2-yl)-N-(2-bromoacetamidoethyl)sulfonamide, (N-(4,4-difluoro-1,3,5,7-tetramethyl- 4-bora-3a,4a-diaza-s-indacene-2-yl)iodoacetamide, N-(4,4-difluoro-5,7-diphenyl-4-bora-3a,4a-diaza-s-indacene-3-propionyl)-N'-iodoacetylenediamine, 5-(((2-iodoacetyl)amino)ethyl)amino)naphthalene-1-sulfonic acid, and carboxy-X-rhodamine, 5/6-iodoacetamide.

62. (New) A glucose biosensor comprising at least one mutated glucose/galactose binding protein and at least one reporter group attached to said binding protein, such that said reporter group provides a detectable and reversible signal change when said mutated binding protein is exposed to varying glucose concentrations;
wherein said at least one mutated glucose/galactose binding protein comprises at least three amino acid substitutions, said at least three amino acid substitutions being selected from the group consisting of a cysteine at position 149 and a serine at position 213 and a serine at position 238, and a cysteine at position 149 and an arginine at position 213 and a serine at position 238; and
wherein said detectable and reversible signal change is related to said varying concentrations.

63. (New) The biosensor of claim 62 wherein said reporter group is a luminescent label.

64. (New) The biosensor of claim 62, wherein said mutated glucose/galactose binding protein has at least one histidine tag.

65. (New) The biosensor of claim 63 wherein said luminescent label is covalently coupled to said at least one mutated glucose/galactose binding protein.

Atty. Dkt. No. 0709.017.0002
Serial No. 10/040,077

66. (New) The biosensor of claim 65 wherein said luminescent label has an excitation wavelength of more than about 600 nanometers.

67. (New) The biosensor of claim 65 wherein said luminescent label has an emission wavelength of more than about 600 nanometers.

68. (New) The biosensor of claim 65, wherein said luminescent label is selected from the group consisting of fluorescein, coumarins, rhodamines, 5- TMRIA (tetramethylrhodamine-5-iodoacetamide), (9-(2(or4)-(N-(2-maleimidylethyl)-sulfonamidyl)-4(or 2)-sulfophenyl)-2,3,6,7,12,13,16,17-octahydro-(1H,5H,11H,15H-xantheno(2,3,4-ij:5,6,7-i'j')diquinolizin-18-iium salt), 2-(5-(1-(6-(N-(2-maleimidylethyl)-amino)-6-oxohexyl)-1,3-dihydro-3,3-dimethyl-5-sulfo-2H -indol-2-ylidene)-1,3-propyldienyl)-1-ethyl-3,3-dimethyl-5-sulfo-3H-indolium salt, N-((2-iodoacetoxy)ethyl)-N-methylamino-7-nitrobenzoxadiazole, 6-acryloyl-2-dimethylaminonaphthalene, pyrene, 6-amino-2,3-dihydro-2-(2-((iodoacetyl)amino)ethyl)-1,3-dioxo-1H-benz(de)isoquinoline-5,8-disulfonic acid salt, 2-(5-(1-(6-N-(2-maleimidylethyl)-amino)-6-oxohexyl)-1,3-dihydro-3,3-dimethyl-5-sulfo-2H-indol-2-ylidene)-1,3-pentadienyl)-1-ethyl-3,3-dimethyl-5-sulfo-3H-indolium salt, 4-(5-(4-dimethylaminophenyl)oxazole-2-yl)-N- (2-bromoacetamidoethyl)sulfonamide, (N-(4,4-difluoro-1,3,5,7-tetramethyl- 4-bora-3a,4a-diaza-s-indacene-2-yl)iodoacetamide, N-(4,4-difluoro-5,7-diphenyl-4-bora-3a,4a-diaza-s-indacene-3-propionyl)-N'-iodoacetylenediamine, 5-(((2-iodoacetyl)amino)ethyl)amino)naphthalene-1-sulfonic acid, and carboxy-X-rhodamine, 5/6-iodoacetamide.